

**MULTI-USER INTERFERENCE RESILIENT  
ULTRA WIDEBAND (UWB) COMMUNICATION**

**ABSTRACT**

Techniques are described for maintaining the orthogonality of waveforms transmitted in ultra wideband (UWB) multi-user wireless communication systems. The multi-stage block-spreading (MS-BS) techniques described herein deterministically eliminate multiple user interference (MUI) in the presence of frequency-selective fading channels. A transmitter includes a block-spreading unit to generate a stream of frames from a block of information bearing symbols by applying an orthogonal set of spreading codes, such as direct sequence code-division multiple access (CDMA) codes or digital carrier frequency multiple access codes, such that the frames corresponding to different blocks of the symbols are interleaved. The transmitter further includes a time-hopping spreading unit to generate a stream of chips from the stream of frames by applying an orthogonal set of time-hopping (TH) spreading codes such that chips corresponding to different frames are interleaved. The stream of chips may be padded with a number of guard chips determined as a function of the length of the communication channel.